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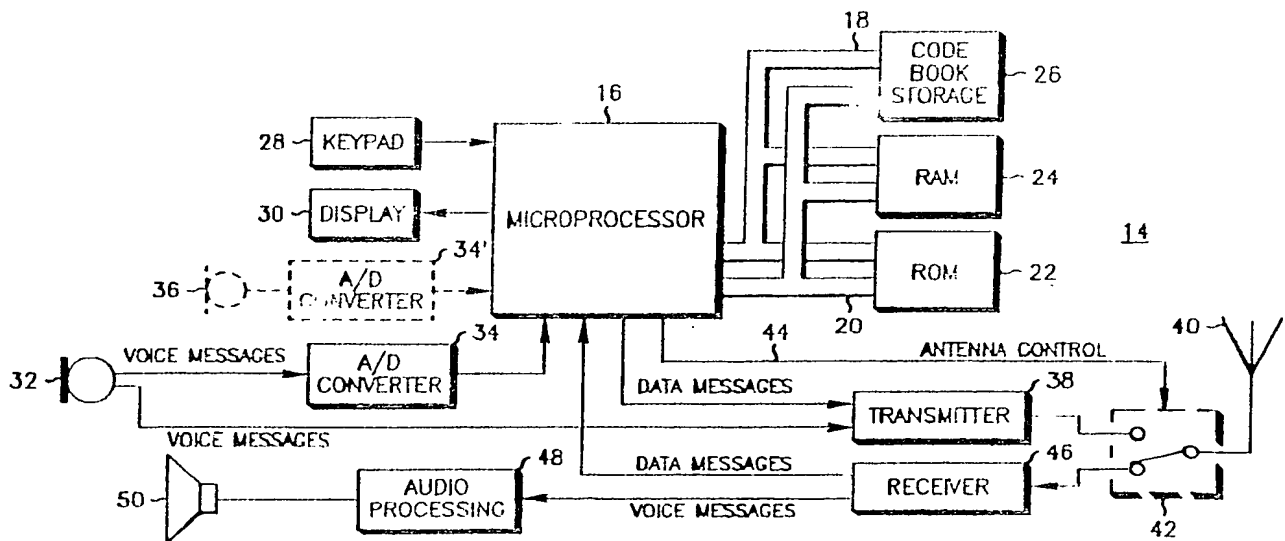
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(57) Abstract

To program a communication device (14) to respond to voice commands (16, 32, 34), an individual desiring to operate the communication device sends a message (38) to a repository of voice recognition codebooks. The repository device(s) respond by transmitting the codebook of that individual to at least one communication device, which stores the codebook therein (26). Thereafter, the communication device may respond to the voice commands of the individual.

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METHOD AND APPARATUS FOR PROGRAMMING
DEVICES TO RECOGNIZE VOICE COMMANDS

10   Technical Field

This invention relates generally to voice
recognition, and more particularly to speaker dependent
voice recognition applied to information communication
15   systems, and is more specifically directed toward a
method for programming communication devices to recognize
and respond to voice commands.

Background Art
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Voice recognition technology has been recognized
as an advantageous feature for many product applications.
Such technology may be employed to render a product
partially or entirely controllable by voice commands in
25   situations where hands-on control is impossible or
impracticable. Presently, however, voice recognition
technology has not found wide use due to the complexity
of its implementation, and requirements for a large
amount of electronic storage (memory).
30   Speaker dependent voice recognition devices are
designed to respond to a particular individual. Stored
within such devices are speaker specific parameters, such

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as, for example, variations in the vocal tract response, pitch period, short-term speech power, and amplitude of the short-term speech spectra. In order for a speaker dependent device to respond to more than one person, the voice recognition information (commonly referred to as a "codebook") for each person must be stored within the device. However, mass codebook storage in each subscriber unit (radio) may prove impractical due to space or cost considerations. An alternative may be to use speaker independent technology, however, speaker independent devices are typically more complex and costly.

When applied to information communication devices, voice recognition technology raises several concerns. One major concern comprises the recognition that communication devices are typically used by more than on individual. For example, police vehicles are generally in service for three ight-hour shifts, during which at least three officers use the vehicle. Moreover, the officers using the vehicle (radio) may be anyone on the entire police force. Therefore, each radio must contain a codebook for each officer on the force. This would significantly increase the cost of the radios. Additionally, codebo : maintenance costs would be significant since the radios must be updated with each change in personnel. Another concern is the increase in radio size. Contemporary state-of-the-art communication devices are designed so as to minimize their physic size. The addition of several memory devices, or a memory printed circuit board, may increase the size of the device beyond that desired by the consuming public. This is a particular concern in the personal pager and handheld radio products.

One solution may be to sto e the codebooks of only a few individuals thereby reducing the amount of required memory. However, this approach is inflexible to changing circumstances such as variation in personnel

working hours or in the event that the radio itself
should fail. Another approach may be to have each radio
contain only enough memory for a single codebook, which
must be retrained for each person. Speaker dependent
voice recognition devices must be "trained" to respond to
5   each individual. Training is accomplished by having an
individual repeat control words several times until the
device has been "trained" to recognize that word as
spoken by that individual. However, training is a time
consuming process and may be very inefficient in certain
10   markets, such as police and fire protection, where rapid
activity is ordinarily required. Accordingly, a need
exists in the art to permit information communication
devices to be programmed to respond to the voice commands
of several individuals in an efficient and organized
15   manner.

Summary of the Invention

Briefly, according to the invention, a
communication device may be programmed to recognize voice
20   commands via a portable programming apparatus. An
identification code is employed to access particular
voice recognition information (codebook) from a
repository containing one or more voice recognition
codebooks within the portable programming device. The
25   programming device responds by transmitting the
identified codebook to at least one communication device,
which stores the codebook therein. Thereafter, the
communication device may respond to the voice commands of
that individual. In this way, the communication device
30   may be rapidly reprogrammed to accommodate changing
operators.

Brief Description of the Drawings

Figure 1 is an illustration of a programming
35   device in accordance with the present invention, and a
vehicle having a mobile subscriber unit installed there;

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Figure 2 is an illustration of an alternate programming device in accordance with the present invention, and a mobile subscriber unit;

Figure 3 is a block diagram of the programming device of Figure 1 or Figure 2;

Figure 4 is a block diagram of a subscriber unit according to the present invention.

Detailed Description of the Preferred Embodiment

Referring now to Figure 1, there is shown a radio frequency prog mming device (10) communicating with a vehicle (12) having a mobile subscriber unit ins illed therein. Preferably, the programming device (10) operates as a repository of all of the codebooks for individuals that may operate the subscriber unit. Alternately, the total collection (or library) of codebooks may be apportioned between two or more programming devices.

The subs iber units may be mobile units, portable units, or control stations. Generally, a portable subscriber unit is designed to be carried on or about the pe on, a mobile subscriber unit is designed to be mounted into va les, and control stations are permanent or semi-permanent installations in alled in buildings or other fixed locations. As used herein, the term subscribers collectively refers to portable units, mobile units or co rol stations.

As mentioned a ove, preferably all required codebooks for all personnel using a communication syst are centrally contain l in the programming device (10). The programming device thus becomes a ce ral repository (library) of the several codebooks. Pr ferably, separate facility may be used to provide "trainin " of the subscriber units. F example, all codebooks for an entire police force may be created by training a subscriber u (or its simulat equivalent) at the

police station, after which the newly created codebooks may be transferred to the programming device via any convenient means. In this way, the codebook library may be maintained. Alternately, the programming device may allow for creation of codebooks by having subscriber operators train the programming device itself.

Each of the subscriber units contain enough codebook memory to store the codebook for at least one individual. Thus, before an individual may use the subscriber unit, his or her codebook must be transferred from the programming device (10) to the subscriber unit. Preferably, codebook transfer is accomplished by entering a codebook identification code on a keypad (14) and depressing a transfer activation button (or switch) (16). The present invention also contemplates several alternatives to effect codebook transfer. One alternate comprises providing each operator with an identification card (or module) that may be inserted into the programming device, which causes an automatic transfer of the appropriate codebook from the programming device (10) to the subscriber unit. In another embodiment, the programming device may itself be voice controlled (speaker dependent) to transfer an identified codebook. In this way, codebook transfer could be controlled since the programming device would only respond to a limited number of speakers. In a further embodiment, the programming device may employ a limited version of speaker independent voice recognition technology, which may be used to effect codebook transfer.

In several circumstances, the operator of the mobile subscriber unit also carries an associated portable subscriber unit, which may be used to maintain communication when the operator is out of the vehicle. Accordingly, the present invention contemplates that the programming device (10) may simultaneously transfer a codebook to a mobile subscriber unit and its associated portable unit.

Once the codebook has been stored in a subscriber unit, the operator may partially (or entirely) control the operation of the subscriber unit by voice commands. Alternately, voice commands may be used in conjunction with manually entered commands (or vice versa) to execute a desired function. Whenever another individual desires to use that subscriber unit (for example, at a change in a working shift), the codebook for the new operator may be rapidly transferred as described above. Optionally, the memory in the subscriber may be expanded (within size and cost constraints) to retain a limited number of the last used codebooks in a first-in-last-out manner. For example, the codebook of the current user and the prior two operators may be retained in the subscriber unit. In this way, if the same three individuals operating the subscriber during the three operating shift were ordinarily repeated day to day, no reprogramming of the subscriber unit would be required.

Referring now to Figure 2, there is shown a programming device (20) communicating via modulated light waves (optics) with a subscriber unit (22). For example, infrared scattering light may be used to t ansfer the codebook fr the programming device to the subscriber unit. discussed in conjunction with Figure 1, a codebook transfer is preferably accomplished by entering a codebook i tification code on a keypad (14) and depressing a ansfer activation button (or switch) (16). Alternately, identification cards (or modules) may be used to cause an automatic transfer of the appropriate codebook from the programming device (1) to the subscriber unit. Also, the programming device may itself be voice controlled (using speaker dependent or independent technology) to tr asfer a iden ified codebook. Lastly as an alternative to ither radio frequency or ligh wave communicati n, codebook transfer may be effected via an interface cable (either conductive wire or fiber optic link) between a programming port (24)

on the subscriber unit (22), and a programming port (24')
on the programming device (10 or 20).

Referring now to Figure 3, there is shown a block
diagram of the programing unit (10 or 20). The
5   programming unit operates under the control of a
microprocessor (30), which communicates via an address
bus (32) and a data bus (34) with read-only memory (ROM)
(36) and random access memory (RAM) (38). The codebook
for each individual resides in mass codebook storage
(40), which preferably comprises electronically erasable
10 programmable read-only memory (EEPROM). Alternately,
battery backed-up RAM may be used.

The operator may enter manual commands via the
keyboard (42), and receive status or information updates
by the display (44). Preferably, in a voice controlled
15 programmer embodiment, voice commands are entered via the
microphone (46), which are digitized (48) and processed
by the microprocessor (30). Codebook transfer is
accomplished via a transmitter (50), which is of a type
in accord with the particular communication media
20 employed. That is, an optics transmitter for fiber optic
cable or infrared scattered transmission, a radio
frequency transmitter for ' communication, or merely a
modulator amplifier for w: line transmission.
Optionally, the programming device (10) may include a
25 receiver e. tion (52) comprising a receiver (54), which
may forward data messages, such as acknowledge ssages,
to the microprocessor (30), while routing analog messages
(such as a programming complete or error signal) to any
suitable audio proce sing stages (56), which may provide
30 an alert tone to ti operator via the speaker (58).

Referring now to Figure 4, there is shown a block
diagram of a subscriber unit (22) according to the
invention. The subscriber unit also operates under the
control of a microproce sor (30), which communicates via
35 an address bus (32) and a data bus (34) wit read-only
memory (ROM) (36) and random access memory (RAM) (38).

The codebook for at least one individual resides in the
codebook storage (40'), which preferably comprises
electronically erasable programmable read-only memory
(EEPROM). Alternately, battery backed-up RAM may be
used.

5   The operator may enter manual commands via the
keyboard (42), and receive status or information updates
by the display (44). Preferably, voice commands are
entered via the handheld microphone (60), which are
digitized (48) and processed by the microprocessor (30).
10   Optionally, a condenser microphone (or equivalent) (46)
may b mounted on the subscriber uni , to recei e voice
commands without the necessity of picking up the handheld
microphone (60). Voice messages are transmitted via the
handheld microphone (60) and a radio frequency
15   transmitter (50'), which may also transmit data messages
from the microprocessor (30). The transmitter (50') is
selectively coupled to the antenna (62) via the antenna
switch (64), which is controlled via the antenna control
line (66) from the microprocessor (J). The subscriber
20   unit (14) may also receive data or voice messages via a
radio frequency receiver (54'), which forwards data
messages to the mic rocessor (30), while routing voice
messages to a   suit le audio processing stages (56),
which may provide the voice message or signalling tones
25   to the operator via the speaker (58).

              The subscriber unit (22) may accept a codebook
for storage in a variety of ways. In a radio frequency
pre ammer embodiment, a subscriber unit (22) may receive
a codebook transmitted from a programming device (10) via
30   the ntenna (62), which is coupled (64) to a receiver
(54'). The recel r (54') routes the received codebook
information to the croprocessor (30), which may store
th codebook in the codebook storage (40'). Optiona y,
an acknowledge message may ` transmitted (50') to th
35   programming device (10) to confi   receipt of the
codebook. In a opt   programmer embodiment, e

subscriber unit (22) is equipped with an optical receiver (or transceiver) (68) to enable the subscriber unit to receiver a codebook transmitted by a programmer (20) via, such as, infrared scattering. Lastly, a subscriber may

5   be provided a programming port (70), which may accommodate a wireline or fiber optic cable to enable the subscriber to receive a codebook.

       According to the invention, a significant level of voice control, may be accomplished by a limited word set. While total voice control may require several

10   additional words, the present invention contemplates that the subscriber unit may be at least partially controlled by the word set as represented in Table 1 below.

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Table 1

EMERGENCY

LIGHTS

SIREN

ON

OFF

MONITOR

CANCEL

STATUS

TRANSMIT

RECEIVE

DISPLAY

SCAN

DIAL

CALL

CHANNEL

ACKNOWLEDGE

MESSAGE

NUMBER

ZERO

ONE

TWO
</div>

20

25

30

35

THREE

FOUR

FIVE

SIX

5   SEVEN

EIGHT

NINE

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10   In summary, the present invention provides that a
communication device may be programmed to recognize voice
commands via the portable programming apparatus described
above. To effe codebook transfer, the programming
device receives an identification code, which is used to
access particular voice recognition inforⁱⁱation from a
15   repository of codebooks contained within the portable
programming device. The identified codebook is
transferred to at least one communication device by
modulated radio waves, modulated light waves, or other
suitable modulated electronic signals. Upon receipt and
20   storage of the code   , the communication device may
respon   the voice commands o that individual. In
this way, the commur ation device may be rapidly
reprogrammed to accommodate changing operators.
   What is claimed is:

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Claims

1.   In a communication system having at
least one subscriber unit being at least partially
5   controlled by voice commands, and at least one
repository station having a data base comprising at
least voice recognition information for said at
least one subscriber unit, a method for programming
said at least one subscriber unit to recognize said
10 voice commands, comprising the subscriber unit
steps of:
    receiving data representing voice recognition
information from said repository station.

15   2.   The method of claim 1, which includes
the subscriber unit step of: transmitting a
message comprising a request for particular voice
recognition information to said repository station
prior to receiving said data representing voice
20 recognition information from said repository
station.

3.   In a communication system having at
least one subscriber unit being at least partially
controlled by voice commands, and at least one
repository station having a data base comprising at

5   least voice recognition information for at said
least one subscriber unit, a method for programming
said at least one subscriber unit to recognize said
voice commands, comprising the subscriber unit
steps of:

10   (a)   transmitting a message comprising a
request for particular voice recognition
information to said repository station;
        (b)   receiving data representing voice
recognition information from said repository

15   station;
        (c)   processing voice commands at said
subscriber unit in accordance with said data
representing voice recognition information to at
least partially control operation of said

20   subscriber unit in response to said voice commands.

        4.   The method of claim 3, wherein said
transmitting step comprises: inserting an
identification card containing at least an

25   identification code into said subscriber unit, and
transmitting a data packet representing at least
said identification code as at least a portion f
said message.

5.   The method of claim 3, wherein said
transmitting step comprises:
        (a)   receiving a voice signal comprising a
command to retrieve said data representing voice
5   recognition information;
        (b)   processing said voice signal in a
speaker independent voice recognition means to
provide a data packet;
        (c)   transmitting at least said data packet
10   as at least a portion of said message representing
a request for particular voice recognition
information.

        6.   the method of claim 3, wherein said
15   processing step comprises:
        (i)   processing, in the absence of manually
entered commands, voice commands in accordance with
said data representing voice recognition
information to at least   partially control
20   operation of said subscriber unit in response to
said voice commands;
        (ii) processing, when said manually entered
commands are present, said manually entered
commands in cooperation with said voice commands
25   processed in accordance with said data representing
voice recognition information to at least partially
control operation of said subscriber unit in
response to said manually entered commands and said
voice commands.

30

7. In a communication system having at least one subscriber unit being at least partially controlled by voice commands, and at least one repository station having a data base comprising at

5 least voice recognition information for at said least one subscriber unit, a method for programming said at least one subscriber unit to recognize said voice commands, comprising the steps of:

at said at least one repository station:

10 (a) transmitting, automatically, data representing voice recognition information to at least one subscriber unit in response to a predetermined event;

at said at least one subscriber unit:

15 (b) information from said repository station.

8.   In a communication system having at
least one subscriber unit being at least partially
controlled by voice commands, and at least one
repository station having a data base comprising at
5   least voice recognition information for at said
least one subscriber unit, a method for maintaining
said data base, comprising the subscriber unit
steps of:
        (a)   creating data representing voice
10   recognition information;
        (b)   transmitting said data representing
voice recognition information to said at least one
central repository.

9.   In a communication system having at
least one subscriber unit being at least partially
controlled by voice commands, and at least one
repository station having a data base comprising at
5   least voice recognition information for at said
least one subscriber unit, a method for maintaining
said data base, comprising the steps of:
     at a first subscriber unit:
     (a)   creating data representing voice
10   recognition information;
     (b)   transmitting at least said data
representing voice recognition information to said
at least one central repository;
     at said at least one repository station:
15   (a)   receiving at least said data
representing voice recognition information from
said first subscriber unit;
     (b)   storing at least said data representing
voice recognition information;
20   (c)   transmitting, upon command, at least
said data representing voice recognition
information to any of said at least one subscriber
unit.

1/2

FIG.1

FIG.2

FIG.3

FIG.4
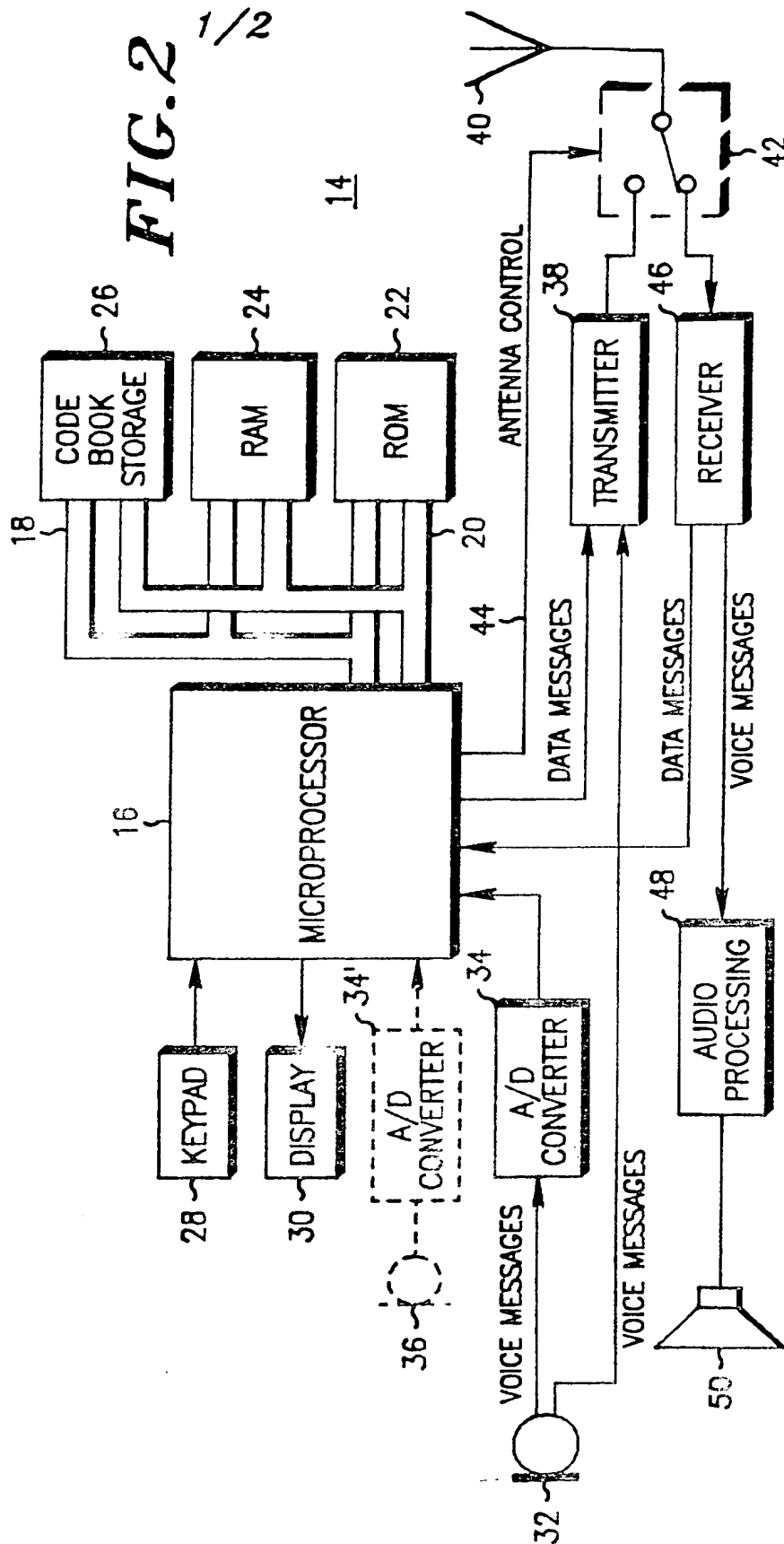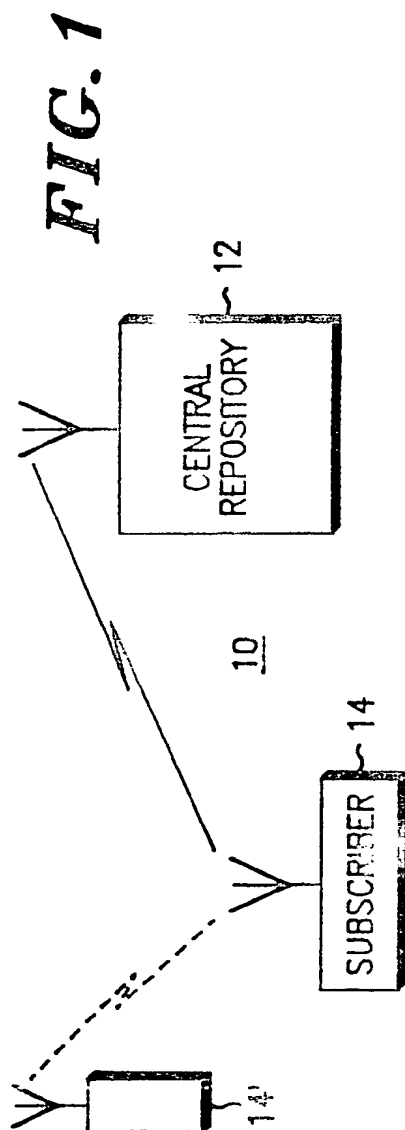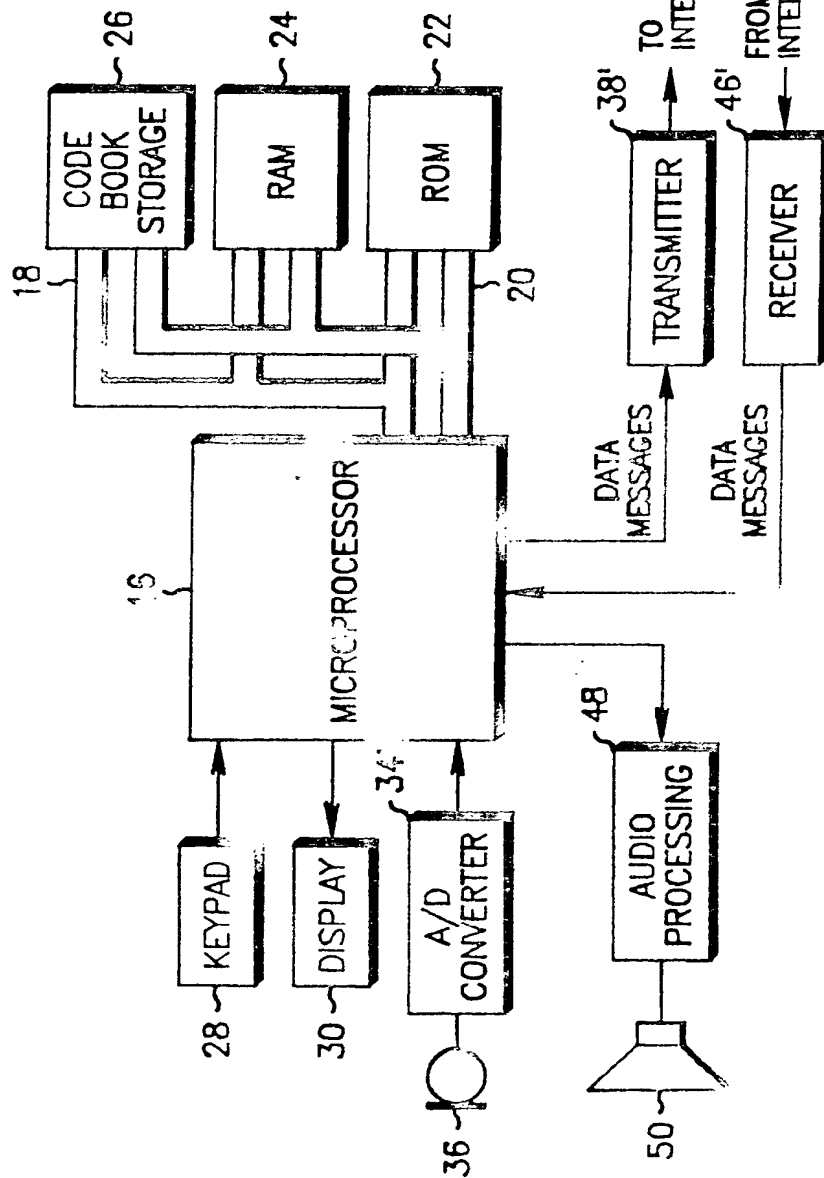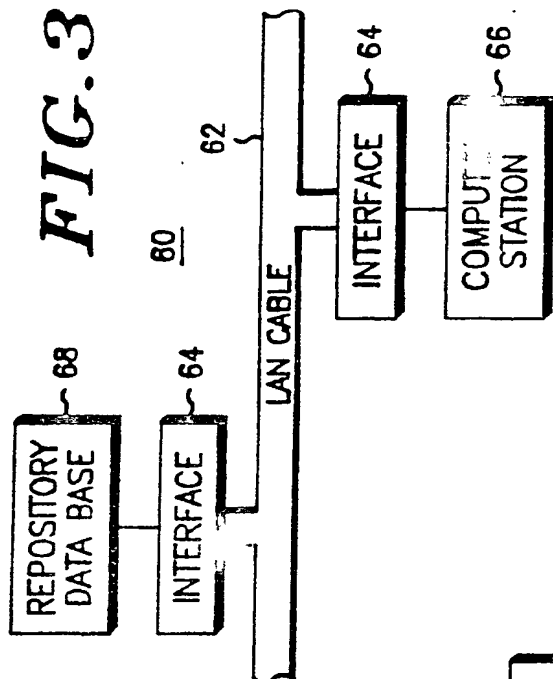
INTERNATIONAL SEARCH REPORT

International Application No. **PCT/US89/02760**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4): G10L 7/08
U.S. CL.: 381/43

II FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
US	381/41-46, 110, 364/513.5, 367/198

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No [13]
Y,P	US, A, 4,797,924 (SCHNARS ET AL.), 10 January 1989, see Figs. 1 and 2A.	1-9
Y,P	US, A, 4,776,016 (HANSEN), 4 October 1988, see Fig. 3.	1-9
Y	US, A, 4,720,802 (DAMOULAKIS ET AL.), 19 January 1988, see col. 10.	1-9
Y	US, A, 4,462,080 (JOHNSTONE ET AL.), 24 July 1984, see Fig. 1.	1-9
A,P	US, A, 4,797,929 (GERSON ET AL.), 10 January 1989, see Fig. 2	1-9

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
04 August 1989	26 SEP 1989

International Searching Authority	Signature of Authorized Officer
ISA/US	JOHN A. MERECKI

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